Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the Editor

Re: 'Non-pharmaceutical intervention strategies for outbreak of COVID-19 in Hangzhou, China'

Kong et al.[1] stated that a large-scale outbreak of coronavirus disease 2019 (COVID-19), with 169 confirmed cases, was quickly controlled by non-pharmaceutical interventions in approximately 6 weeks and that the intervention strategies could be helpful to other countries experiencing the COVID-19 pandemic. However, as Kong et al.[1] mentioned, the interventions implemented lacked strong scientific basis and effective evaluation. In this letter, we try to evaluate the science behind these strategies by retrospective analysis of the case-control method.

The core intervention strategy in Hangzhou was to adopt the corresponding isolation strategies at different stages of the COVID-19 epidemic: namely, isolation of patients or suspected patients and quarantine of close contacts at the early stage of the epidemic, followed by community-wide containment after the disease started to spread locally. Hence, our research focused on key factors such as exposure history, confirmed close contact, travelling to high risk areas and living in the same community as a confirmed case. In addition, we considered patient age and living region (urban or suburban), which could have an impact on the analysis of results. In our research, up to 31 May 2020, 200 confirmed COVID-19 patients (including 19 asymptomatic cases) were selected (case group) in addition to 588 excluded cases of suspected patients (control group). The difference in COVID-19 morbidity rate between the case group and control group was analysed using an unconditional logistic regression model.

The results showed that COVID-19 morbidity risk increased with age and that the risk was higher for individuals living in suburban areas than those living in urban areas. After controlling for age and region variables, exposure history stood out as a risk factor. The morbidity rate of patients who had close contact with confirmed cases was 66.09 times higher than that of individuals who had no clear contact with confirmed cases. In addition, the morbidity rate of patients who had travelled to Wuhan (high risk area) was 6.58 times higher than that of those who had no clear contact with confirmed cases (Table 1).

These results fully illustrate the importance of case isolation and management of close contacts, which were implemented at all stages of the epidemic, according to Kong et al.[1] The earlier the confirmed cases were located and the stricter the management of close contacts and personnel with a history of exposure in key areas, the better the prevention control effect of the epidemic. Similar results have been seen in Singapore, Hong Kong and other places.[2–4]

According to our results, living in the same community as a confirmed case is not a risk factor; however, community-wide containment should not be deemed as unnecessary. In Hangzhou, more than 5000 close contacts were placed in to quarantine,[5] more than 400,000 nucleic acid tests were conducted between April 8 and June 1[6] and more than 21 million (including the floating population) people used the health code declaration through their smart phones up to May 15.[7] We believe that effective case isolation and close contact quarantine in Hangzhou are the main reason that living in the same community with confirmed cases was not a risk factor. Community control, as implemented during the second stage of the epidemic in Hangzhou, is still very necessary in countries with widespread community transmission. Community-wide containment is particularly important when case isolation and close contact quarantine cannot be achieved, when extensive testing cannot be carried out in the community[8–10] and when there is no sensitive surveillance system available (including hospital and community monitoring).

Table 1
Unconditional logistic regression analysis of risk factors for COVID-19 cases in Hangzhou.

Factors	B	S.E.	Wald	P	OR (95% CI)[a]
Age	0.03	0.01	15.41	<0.001***	1.03 (1.01,1.04)
Region	1.29	0.24	29.92	<0.001***	3.62 (2.28,5.75)
Exposure history			196.78	<0.001***	
Close contacts	4.19	0.35	145.05	<0.001***	66.09 (33.41,130.72)
Wuhan exposure	1.88	0.31	36.74	<0.001***	6.58 (3.58,12.10)
Hubei Province exposure	0.00	0.47	0.00	0.998	1.00 (0.40,2.49)
Same community with confirm cases	−0.98	1.05	0.87	0.351	0.38 (0.05,2.93)
Other location exposure	−0.16	0.44	0.13	0.720	0.85 (0.36,2.02)

*P value < 0.05, **P value < 0.01, ***P value < 0.001.
COVID-19, coronavirus disease 2019.
[a] 95% credibility interval (CI) after excluding 1 means its odds ratio (OR) value had statistical significance.

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Furthermore, we discovered a significant difference in risk between urban and suburban areas. Individuals in the case group were mainly living in suburban areas, whereas the control group population was mainly from urban areas. The reason behind the difference may be due to a gap between urban and suburban/rural areas in terms of health resources, personal health literacy and supportive environment. Individuals living in urban areas have relatively more abundant health resources, are more sensitive to health hazards and have a relatively higher degree of concern for their own well-being. In general, individuals in urban areas have healthier preventative behaviours, such as actively and correctly wearing face masks and more frequent hand washing. They are also more likely to go to the hospital for treatment and corresponding screening if COVID-19 symptoms developed. According to the health literacy monitoring data of Hangzhou residents in 2019, there is a significant gap between urban and rural residents' health literacy.[11] Knowledge and skills of protection from respiratory infectious diseases greatly impact the probability of infection.[12] It is evident that health resources, personal health literacy and health support environment have a great impact on COVID-19 infection and diagnosis. Therefore, these factors should be considered in the prevention and control strategy to develop more appropriate prevention for different regions.

Author statements

Ethical approval

This study did not require ethical approval (data collection and analysis of cases and close contacts were determined by the National Health Commission of the People's Republic of China to be part of a continuing public health outbreak investigation and were thus considered exempt from institutional review board approval.)

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Competing interests

None declared.

References

1. Kong Q, Jin H, Sun Z, et al. Non-pharmaceutical intervention strategies for outbreak of COVID-19 in Hangzhou, China. *Publ Health* May 2020;**182**:185–6.
2. Lee VJ, Chiew CJ, Khong WX. Interrupting transmission of COVID-19: lessons from containment efforts in Singapore. *J Trav Med* 2020;**27**. https://doi.org/10.1093/jtm/taaa039. taaa039.
3. Cowling BJ, Ali ST, Ng TWY, et al. Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study. *Lancet Publ Health* 2020;**5**:e279–88. https://doi.org/10.1016/S2468-2667(20)30090-6.
4. Triggle CR, Bansal D, Abd Farag EAAB, et al. COVID-19: learning from lessons to guide treatment and prevention interventions. *mSphere* 2020;**5**:e00317–20. https://doi.org/10.1128/mSphere.00317-20.
5. Wu Y, Song SJ, Kao QJ, et al. Risk of SARS-CoV-2 infection among contacts of individuals with COVID-19 in Hangzhou, China. *Publ Health* 2020;**185**:57–9. https://doi.org/10.1016/j.puhe.2020.05.016.
6. Zhejiang Newspaper. *Zhejiang will continue to increase the detection of nucleic acid in new coronary pneumonia virus*. 2020. https://news.hangzhou.com.cn/zjnews/content/2020-06/03/content_7747996.htm. [Accessed 18 June 2020].
7. Zhejiang Online. *21.24 million health codes have been issued in Hangzhou*. 2020. http://shoujibao.net/news/publish/wap/pzx/wapstation/news/index.jsp?c=33123217&WD_CP_ID=000000&isShowTop=0. [Accessed 18 June 2020].
8. Fisher D, Wilder-Smith A. The global community needs to swiftly ramp up the response to contain COVID-19. *Lancet* 2020;**395**:1109–10. https://doi.org/10.1016/S0140-6736(20)30679-6.
9. Mark K, Steel K, Stevenson J, et al. Coronavirus disease (COVID-19) community testing team in Scotland: a 14-day review, 6 to 20 February 2020. *Euro Surveill* 2020;**25**:2000217. https://doi.org/10.2807/1560-7917.ES.2020.25.12.2000217.
10. Lai SJ, Ruktanonchai NW, Zhou LC, et al. Effect of non-pharmaceutical interventions to contain COVID-19 in China. *Nature* 2020. https://doi.org/10.1038/s41586-020-2293-x. Online ahead of print.
11. Hangzhou Municipal Health Commission. *How is the health literacy level of Hangzhou citizens in 2019*. 2020 [accessed, https://mp.weixin.qq.com/s/TffNG6TbZ66iUNftyppz-A. [Accessed 18 June 2020].
12. West R, Michie S, Rubin GJ, et al. Applying principles of behaviour change to reduce SARS-CoV-2 transmission. *Nat Hum Behav* 2020;**4**:451–9. https://doi.org/10.1038/s41562-020-0887-9.

S.J. Song, Q.X. Kong, C.P. Huang, X.H. Yang, M.W. Liu, Q.J. Kao, Z. Sun, J. Wang*
Department of Infectious Disease Control and Prevention, Hangzhou Center of Disease Control and Prevention No.568 Mingshi Road, Hangzhou, 310021, China

* Corresponding author.
E-mail addresses: redapple787878@yeah.net (S.J. Song), kqx79@sina.com (Q.X. Kong), 529803835@qq.com (C.P. Huang), 39178682@qq.com (X.H. Yang), l20101003@yeah.net (M.W. Liu), kaoqj@163.com (Q.J. Kao), 178972868@qq.com (Z. Sun), jackiewong203@163.com (J. Wang).

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